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# The Principle of Feeling - the Method of Structural Systemic Constellations for Technical Problem Solving and Decision Making

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## Abstract

Systemic Constellations are a phenomenological approach to resolving personal, professional and organizational issues. They offer a way of mapping a present reality, working at the source of the hidden dynamics and moving to a resolution. This systemic approach often delivers surprising and unexpected insights while also offering the possibility to analyze and solve organizational problems. Rational analysis provides the whole picture of the problem which often turns out to be too complex for a decision making. Systemic constellations can help to simplify and clarify the situation and inform what has to happen next [8, 17]. The outcomes of systemic constellations as an additional resource for solving comprehensive technical problems have not yet been sufficiently investigated. In structural constellation work dealing with technical problems, the individuals who are involved in the problem situation are used to represent different system components, substances or fields. A moderator voices the feedback from the representatives concerning their feelings or intuitive movements, and points to possible solutions. For example, a moderator places the representatives somewhere in the room, develops a three-dimensional picture of the constellation of the analyzed situation and tries to expose the factors empowering or blocking the way towards constructive solutions [13]. This paper explores the theoretical background and practical outcomes of the systemic constellation method for technical problem solving. It presents some case study work which has been conducted in recent years, and then discusses its findings and implications. The research outlined in this paper demonstrates that the noteworthy contribution of structural constellation work for problem solving is typically the result of a combination of functional analysis and the feeling-as-information principle. The constellation work helps, at first, to reveal the subjective experiences, such as feelings, moods, emotions, and bodily sensations, and then to accept them as a source of objective information relevant to the decision making process. In accordance with the latest research [19], the use of feelings as a source of information follows the same principles as the use of any other information. This paper provides the structures of some standard templates and types of constellation work for technical problems, and discusses the preconditions for their application.

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## 1. Introduction

In the last decade industrial companies as well as academia [1, 3, 4, 5, 9, 10, 11, 14, 15, 16, 18, 21] have gathered considerable experience in enhancing the systematic thinking and problem solving skills of engineers and engineering students. The research results confirm that a systematic problem solving approach not only leads to better quality and more robust solutions in a wide variety of situations, but also requires no more time than the intuitive approaches [20]. At the same time, in a realistic industrial environment, the approaches actually used to deal with technical problems are often intuitive and non-systematic. One explanation why people in organizations tend to use inefficient intuitive problem solving is the physiological nature. Engineers habitually trust in spontaneous “good” solutions and assume that systematic problem solving takes longer than intuitive work. This naturally intuitive way of thinking can be used purposefully to enhance systematic problem solving work.

According to psychologists, most people are poor intuitive problem solvers. They tend to adopt a problem definition and to generate ideas based upon incomplete data, therefore failing to seek out possible alternative explanations. Even when information is available, it is often ignored if it does not support existing preferences and assumptions [7]. Consequently, organizations and engineers need a robust method for amplifying intuitive problem solving facilities. In such situations, a psychological approach of structural systemic constellations can be very helpful. This method was originally proposed by a German psychologist, Bert Hellinger, for finding solutions to family, organizational, or cultural systems within difficult systemic conditions [6, 8, 17]. Constellation work for technical problem solving can be introduced into workshops as an additional technique for the in-depth identification of a problem situation as well as for the ideation phase and for the evaluation of possible solutions [13].

Constellation work helps to reveal the subjective experiences, such as feelings, moods, emotions, and bodily sensations, and then to accept them as a source of objective information relevant to decision making. In accordance with the feelings-as-information theory [19], the use of feelings as a source of information follows the same principles as the use of any other information. The feelings-as-information theory conceptualizes the role of subjective experiences in decision making. It assumes that people attend to their feelings as a source of information with different feelings providing different types of information. Whereas feelings elicited from judgments provide valid information, feelings that are due to an unrelated influence can lead us astray. Most importantly, people do not rely on their feelings when they (correctly or incorrectly) attribute them to another source, thus undermining their value for the task at hand. Based on empirical observations, and on the direct experiences of the current situation, feelings tune our thought processes to meet the situational requirements [19].

This paper examines the role of structural systemic constellations (SSC) for technical problem solving and addresses the following questions:

1. Does an SSC contribute to better problem solving outcomes in an industrial environment?
2. When, and for what types of technical problems, is an SSC method more useful?
3. Which preconditions are necessary for the successful application of an SSC?

## 2. The method of Structural Systemic Constellations

The understanding of systems and systemic thinking is not new. It was Aristotle who said “The whole is greater than the sum of its parts”. But looking at the whole system can simply create a bigger and more complex picture. The word “system” comes from Greek and literally means “stand together”. The word “constellation” comes from Latin and means “a collection of objects which together form a pattern.” It is from these meanings that this approach derives its name and methodology.

In the typical procedure of Systemic Constellations, a group of participants (6-15 people) is led by a trained facilitator. One participant (issue holder) presents a personal issue or organizational problem. The others either serve as representatives for the system's elements or actively contribute by observing.

During the first step the facilitator asks for information about the issue and looks for the origin of the problem in the past that may still have systemic resonance. Following this, the facilitator asks the issue holder to select specific group members to represent specific system parts and then moves them into place. Once the representatives are in position they stand without moving or talking and try to tune into the resonance of the system field.

The facilitator observes and may ask each representative, "How are you feeling?" The representatives may be without emotions or they report strong emotions or physical effects. The reports are subjective and contain some aspects of personal projection. However, the intermixing of subjective personal projections with field resonance does not contaminate the process as a whole. The facilitator works slowly with this system pattern, helping the hidden systemic dynamics to come into clear view.

It can be seen that a systemic constellation is a 'living map' made up of people representing the essential elements and influences around a personal or organizational issue. They are placed in relation to each other - standing together and forming a pattern. This pattern is recognizable to the issue holder as an external image of an internal sense of the situation. At the same time, this pattern can be interpreted and explored by a trained systemic facilitator to find hidden resources and paths to a resolution, postulating that everyone and everything has their 'right place' in the system.

In a piece of systemic constellation work for technical problems, a moderator may choose representatives out of a group of workshop participants to stand for different system components, substances or fields, positive or negative effects, persons or organisations, and for other aspects that are important in the dynamics of the conflict situation the team is dealing with [13]. The moderator places these representatives somewhere in the room in order to get a picture of the constellation of the analysed situation. The distances and positions between the representatives and their feelings provide important information about the present situation, and can offer potential systemic solutions for the future. For example, a constellation may bring to light places where important elements or interactions were excluded, thereby revealing factors that empower or block the way towards a constructive solution. In terms of the TRIZ substance-field analysis, the systemic constellation method delivers additional informational resources ("informational" field) which can be efficiently utilized at any step of the problem solving process.

There are some visible parallels between the application of the systemic constellations for technical problems, and the method of Empathy and the method of Modelling with «little people» known from TRIZ methodology [2, 22]. The essence of empathy consists of identifying oneself with a particular technical system, or its parts, and exploring possible alterations to the system from unusual perspectives. However, empathy shows its weakness in cases of transformations to the technical system which appear to be unacceptable for human beings, such as dissolving, segmentation, or burning. It is also quite difficult to identify oneself with a complex technical system and to reflect on all the interactions between all system parts.

The method of modelling systems with the aid of «little people» helps to overcome the drawbacks concerning empathy and to beat psychological inertia. It can also be used for the modelling of innovation principles [12]. In comparison to both these methods, the systemic constellation approach reflects on implicit system dynamics and requires neither identification with the system or its parts (empathy), nor proactive transformation of the system with "little people" towards an Ideal Final Result. In some of his seminars, G. Altshuller [2] also used an exercise in which participants played the role of the "little people" and thus modelled the system dynamics. Unfortunately, we did not succeed in finding any documented statements regarding how close this practice was to the method of systemic constellations.

### **3. Case study 1: Application of the SSC method for problem solving**

The SSC-method for technical problem solving is illustrated in this paper with the help of two case studies. The first case study describes a problem solving process for a special type of optical image projection system using a transparent and miniature liquid crystal display (LCD) as the image carrier for projection onto the screen, as shown in Fig. 1. The light produced by a light bulb passes through the image carrier and, with the help of the optical system

(lenses), displays the enlarged image onto a distant surface, for example a screen. In spite of the powerful cooling fan, the image carrier overheats very quickly due to the amount of heat emitted by the light source.

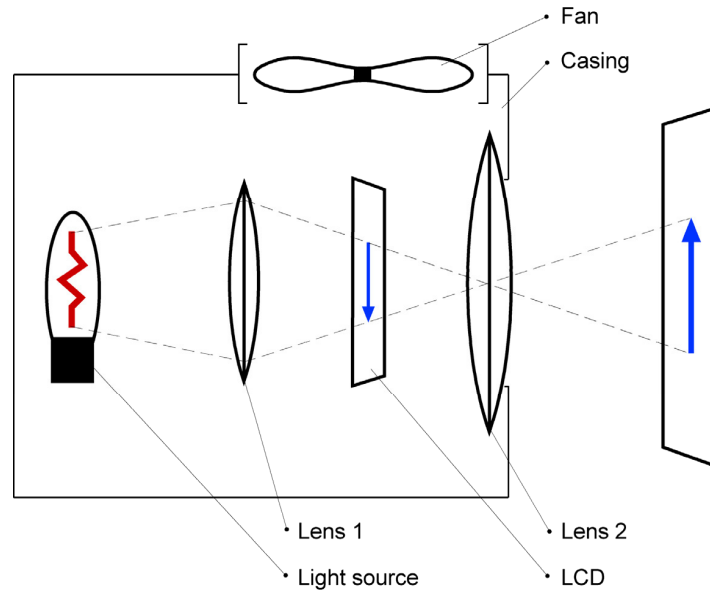


Fig. 1. Case study 1: initial image projection system.

The initial situation analysis, which should be completed before constellation work begins, includes the identification of relevant system components and their functions as well as the corresponding interactions within a system (Table 1). The results of this analytical phase are illustrated by the circle diagram (Fig. 2), which serves as a starting position for the participants of the systemic constellation. Each person is representing in the circle diagram one system component.

Table 1. Case study 1: Identified interactions between the system components.

No.	Pair of interacting components	Description of the interaction
1	Light source – LCD ( image carrier)	The light source illuminates the LCD image carrier but heats up the image carrier, limiting its service life.
2	Lenses (optical system) – LCD (image carrier)	The lenses enable the projection of the image on the LCD onto a distant surface, but store heat and lead to a buildup of heat around the image carrier.
3	Light source – Casing	The casing stores the heat emitted by the light source.
4	Light source – Lenses (optical system)	The light source heats up the lenses and, as a result, increases the thermal load on the LCD image carrier.
5	Fan – LCD (image carrier)	Increasing the performance of the fan also increases the suction of dust particles into the casing, which leads to soiling of the image carrier.

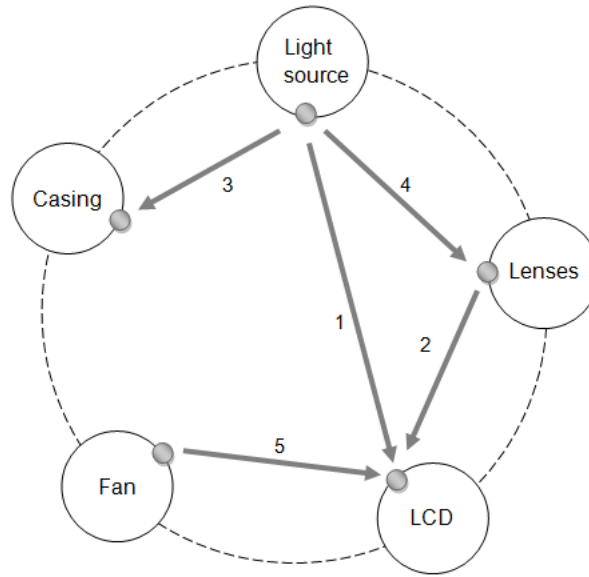


Fig. 2. Case study 1: circle diagram as recommended initial position of the participants at the beginning of constellation work.

In the systemic constellation of this problem situation six participants were selected to represent different system components: light source, LCD image carrier, optical system (2 people for lens 1 and 2), fan and casing. The facilitator inquires and analyses the feelings of each representative, adding or moving representatives and trying to find a “right” and stable position for each participant. The movements of the representatives as well as their feelings may contain information about a potential systemic solution.

Following this, the facilitator places the participants in accordance to the simplified technical scheme of the system, as is shown in Fig. 3a, carefully documenting the statements of participants as follows.

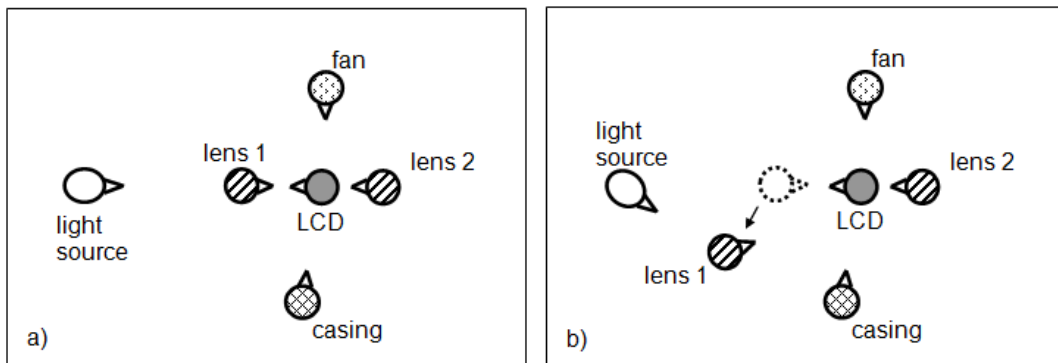


Fig. 3. Case study 1: position of the participants in accordance to the technical scheme of the system (a); final solution position (b).

A participant who represented the LCD image carrier reported that he felt uncomfortable and was too close to “Lens 2”. After the distance between representatives “LCD” and “Lens 2” was enlarged, the LCD-representative notified that “Lens 2” was hindering his direct view toward the “Light source”. After “Lens 2” was moved, the “LCD” asked

the “Light Source” not to look at him directly (Fig. 3b). The final position of the representatives, as shown in Fig. 3b, underlines the unexpected importance of the interaction 2 between the lenses and the LCD (see Table 1). This position was later identified as one of the solution concepts with the light source illuminating the LCD indirectly with the help of the multi-layered mirror which was able to filter out harmful UV and IR elements within the light spectrum (Fig. 4).

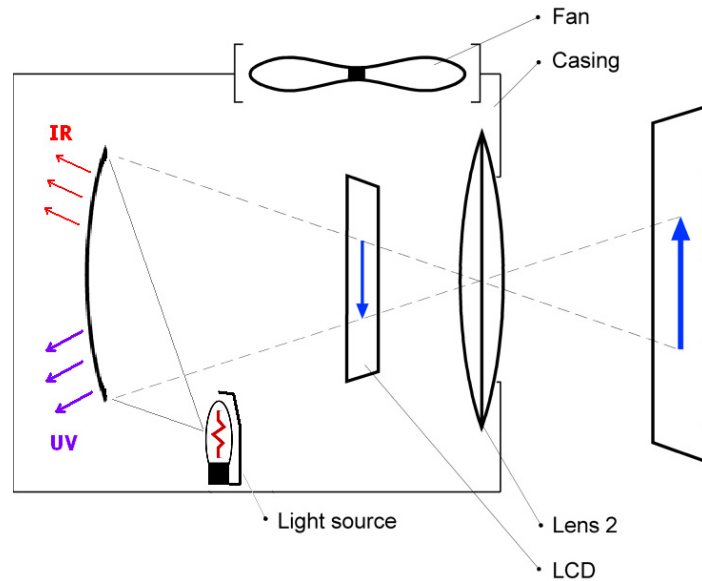


Fig.4. Case study 1: solution concept corresponding to the final constellation position (Fig. 3b).

A comparison of this solution idea and the ideas created with the help of 40 TRIZ inventive principles (see Appendix A) shows that the systemic constellation method can be considered as a supplementary inventive “principle of feeling”, which delivers valuable information for problem solving.

#### 4. Case study 2: Application of the SSC method for failure identification

Case study 2 deals with the application of a structural system constellation for the identification of possible failure causes. A ballpoint dispensing unit, shown in Fig. 5, performs the metering and mixing functions for two fluids, which are fed through the inner and outer pipes.

In almost every thousandth dispensing unit (error rate  $< 0,1\%$ ) the ball becomes stuck between the pipes after its delivery, despite the proposed protective transport packaging. The ball is wedged during transport, probably due to vibrations, between the guiding surfaces of the inner and outer pipes. This effect, however, cannot be reproduced under laboratory conditions. A statistically representative field experiment can last several months. The SSC method was applied here for the evaluation of proposed failure hypotheses.

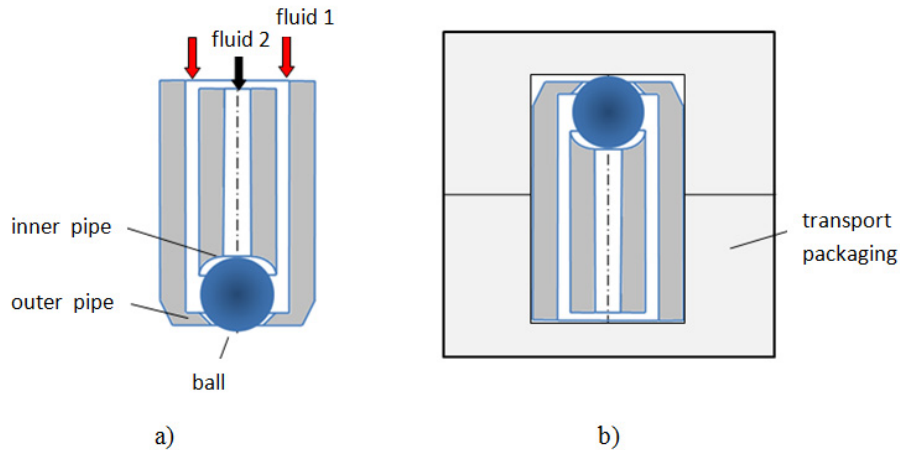


Fig.5. Case study 2: dispensing unit in a working position (a) and in the protective transport packaging (b).

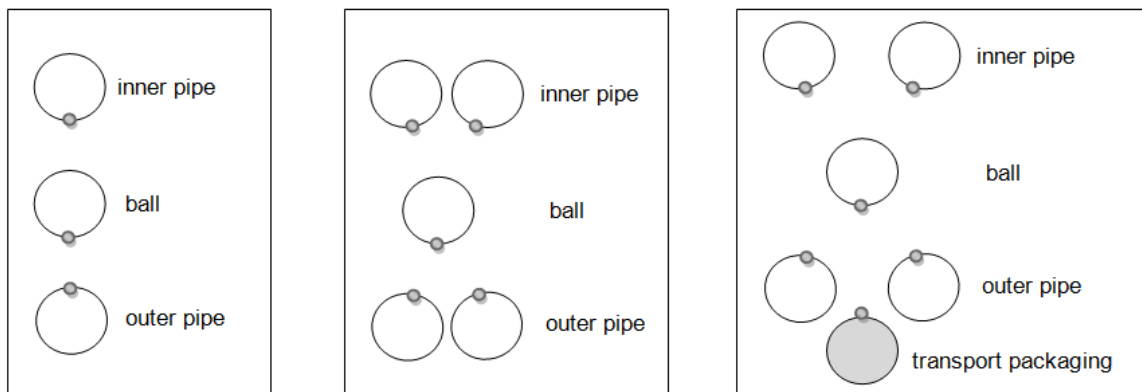


Fig.6. Case study 2: initial (a), intermediate (b) and final (c) positions of participants in the systemic constellation.

In the systemic constellation of this problem, three people were chosen to represent the ball, the inner pipe, and the outer pipe (Fig. 6a). The participants reported their perceptions of the initial position in Fig. 6a as follows:

- Representative of the ball: "Everything is in order. I feel good and relaxed."
- Representative of the inner pipe: "I need more support in the back, do not feel stable enough."
- Representative of the outer pipe: "I also wish to have more support in order to stand in front of the ball safely."

A slight change in the distance between the representatives, both in reduction and enlargement, brought no noticeable change to the feelings of the participants. Their statements were apparently based on a previously developed solution idea to increase the stability and rigidity of both pipes. The participants were apparently influenced by this existing solution concept. Thus, a series of further constellation work was required.

To support the "weakening" representatives of the pipes, two other people were introduced by the facilitator into the constellation for the inner and outer pipes (Fig. 6b). Even this attempt brought no essential changes. The ball-representative felt as safe as before. The real cause of the problems, which leads to the jamming of the ball, remains unrecognized. In such situations, it makes sense to bring additional system components, system resources or even unknown components (X-elements) into the constellation in order to gain new insights. The introduction of the

protective shipping container into the field led to a sudden feeling of unrest for the ball representative (Fig. 6c). This can be interpreted as an indication of an unrecognized origin of error, namely the packaging itself. The packaging material can be pushed into the head of the dispensing unit during transport. This could be, for example, the case when a pallet with several layers of packaging is discharged abruptly.

## 5. Summary: the Principle of Feeling

The method of Structural Systemic Constellations can be considered a valuable tool for technical problem solving, helping to use the “Principle of Feeling” in the most objective manner. The systemic constellations deliver specific added value by identifying new solutions through a better understanding of the emotional experience. At the same time, the constellation work does not deliver the exact final technical solution. The findings obtained in a constellation could be used as a recommendation or as additional information, discovering a “missing link” for decision making. It is the task of the facilitator to prepare the representatives to recognize and respect their own feelings and physical perceptions, and to share and use feelings the same as any other source of objective information. The precise way in which systemic constellations work is still not scientifically proven. The aspect of reproducibility also remains insufficiently explored. It appears that two constellations made for the same problem, and for different facilitators and representatives, delivered quite different results. However, structural systemic constellation work can be recommended for the following applications in problem solving and other innovating activities:

- a) Analysis of the initial problem situation and choice of the crucial conflicts and contradictions: here, the representatives have to stand for different system components.
- b) In-depth analysis and refining of formulated technical contradictions: representatives act as system components which build the contradiction as well as for positive and negative interactions within a contradiction.
- c) Idea evaluation and choice of the best solution concepts: representatives act as existing and new system components within a new technical system, where a contradiction or problem seems to be solved.
- d) Evaluation of the possible failure sources and scenarios without the time consuming and expensive experimental phase; identification of the unspoken feelings of engineers into clear reasons for possible system failures.
- e) Identification of concealed customer needs and benefits as important information for the definition of innovation tasks and strategies.

A careful analysis of further case studies should help to explore and evaluate objectively all application possibilities of systemic constellation work for technical problem solving.

## Appendix A.

### Case study 1: Examples of solution ideas created with the help of 40 TRIZ innovation principles.

1. Utilisation of a transparent plastic IR and UV filter between the light source and the image carrier.
2. Utilisation of specially coated lenses, e.g. a thin layer of silver between two layers of titanium dioxide, which is still transparent to visible light but reflects IR radiation.
3. Installation of an optical system to refract and reflect the light to separate the IR and UV radiation.
4. Installation of an optical system to polarize and modulate the light to separate the IR and UV radiation.
5. Installation of multi-layered dielectric mirrors to filter out the specific elements within the spectrum.
6. Installation of a sandwich of liquid-filled filters containing a transparent coolant (circulating if necessary).
7. Integration of filters and transparent coolants within the optical system, e.g. the lenses.
8. Utilisation of a liquid optical filter, which is continuously circulated to improve the transfer of heat.
9. The LCD image carrier is directly cooled by a liquid which has the following properties: high boiling point, good dielectric properties, transparency, low viscosity - e.g. synthetic, siloxane-based liquids.
10. Amplification of the cooling effect and the heat transfer by using phase transitions e.g. installing heat exchanger tubes.
11. Application of thermo-electric effects e.g. Peltier elements to intensify the cooling.
12. Utilisation of liquid gasses as coolants.
13. Application of aerodynamic cooling effects: e.g. Ranque effect.



14. Applying thermodynamic cooling effects.
15. A mechanical system (e.g. fan) breaks the light beam between the light source and the LCD image carrier at a frequency greater than 50Hz. This then reduces the thermal stress upon the image carrier, while also providing additional ventilation for the system.
16. Electronic interruption of the light using the Kerr effect or magneto-optical effects.
17. Installation of a system of two or more LCD image carriers which are illuminated alternatively and so can cool down during their inoperative phase.
18. Utilisation of a light bulb with a special internal coating, e.g. from silver and titanium dioxide, which emits little IR radiation.
19. Synthesis of a light that does not emit UV and IR radiation, e.g. “white” laser light.
20. Conversion of the IR and UV spectrum into visible light using reflection effects and lighteners.

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